matic data showed an internal hip rotation in 44.3% of the cases, an external hip rotation in 18.1% and a neutral hip rotation in 37.6%. Among the 57 patients with clinical internal hip rotation < 60%, cinematic data showed an internal hip rotation in 28% of the cases, an external hip rotation in 24.6% and a neutral hip rotation in 47.4%.

Discussion.– Excessive femoral anteversion is not explained by excessive kinematic internal hip rotation in 55.7% of the cases. In 49% of the cases, the inside patella gait pattern is explained by an internal pelvic rotation. When the pelvic rotation is neutral or external, the inside patella gait pattern should be explained by the gracileus spasticity.

Conclusion.– The inside patella gait pattern doesn't necessarily imply excessive femoral anteversion. The physical examination alone is not sufficient to analyze the inside patella gait pattern and cinematic data from gait analysis remain necessary for therapeutic decisions.

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Modular posture orthesis for the lower limbs (POMMI) for the cerebral palsy patient

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Keywords: Cerebral Palsy; Apparatus

Objectives.– Our therapeutic protocol in children with cerebral palsy includes an early introduction of night-posture for the spastic muscles.

The polyarticular anatomy of the concerned muscles require a staged immobilization (ankles, knees and hips).

In front of the important difficulty for families to set up the big cruropedal orthesis with fixed abduction, we imagined a modular orthesis fixing the different joints (ankles, knees and hips) in an ascending way.

Method.– After having resolved the administrative problems linked to the additional cost of this modular orthesis, we followed the implementation of 46 orthesis in specialized consultations.

With the orthoprothesist, we defined the specifications of this modular orthesis. It consists of anti-equinus ankle-foot orthesis fit into postural kneepads connected by an adjustable and removable system to control the abduction.

Result.– We cannot compare with analytical element the modular orthesis with the fixed one made before, but satisfaction of families about ergonomics and tolerance of the modular orthesis led us to abandon the fixed one.

Discussion.– The modular orthesis has the inconvenience to be more expensive but offers better tolerance, it can be adjusted to adapt to the growth of the child and can be used to posture the limb in a segmental way.

Conclusion.– The modular postural orthesis of lower limbs improves tolerance and compliance with the same orthopaedic aims as the fixed orthesis. We continue to improve it to make the installation simpler and safer.

Further readings

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Quantitative measurement of muscle strength of lower limbs in children: Validation study

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Keywords: Strengh; Child; Lower limb

Objectives.– Botulinum toxin, used in case of focal spasticity, has for principal physiological effect to decrease the transmission of the input at the level of the neuromuscular junction, which reduces the intensity of the muscle contraction. For this reason, injections of botulinum toxin could enable decreased strength of the injected muscle and an increased strength of the antagonist muscle [1] through retrograde axonal transport at the medullar level. To confirm this hypothesis, a validated tool for the muscle strength measurement is required. The aim of this study was to validate an electronic dynamometer quantifying muscle strength in healthy children. By this mean it will be usable in children with cerebral palsy.

Materials, patients and methods.– An electronic dynamometer (ISOBEX® 2.1, Cursor AG, Bern, Switzerland) [2], wall or ground mounted with a double sucker, was used to assess 20 healthy children aged six to ten years. Four muscular groups were tested (dorsal and plantar flexors of the ankle and flexor and extensor of the knee) at two times, fourteen days apart. Three trials with a prior test were performed with resting of 15–30 seconds between each trial. The statistical analysis was made on the average of the three measures with a two way RM Anova (repeated measures analysis of variance).

Results.– We observed a significant difference for age for all muscle groups tested (all P-values < 0.022) and an absence of significant difference between the two sessions for all muscle groups (all P-values > 0.155).

Discussion and conclusions.–These results should be taken with caution because the number of subjects. However, they are encouraging for the use of ISOBEX® in clinical practice to assess muscle strength of the lower limb in children. Note that the significant difference in strength between younger and older children was expected.

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CO24-006–EN

Quantification of muscle strength of lower limbs before and after injection of botulinum toxin A in children with cerebral palsy

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Keywords: Spasticity; Botulinum toxin A; Strength; Children

Objectives.– Botulinum toxin, used in case of focal spasticity, has for principal physiological effect to decrease the transmission of the input at the level of the neuromuscular junction, which reduces the intensity of the muscle contraction. For this reason, injections of botulinum toxin could enable decreased strength of the injected muscle and an increased strength of the antagonist muscle [1] through retrograde axonal transport at the medullar level. The aim of this study was to quantify muscle strength of knee flexors and extensors before and after the injection of botulinum toxin A in the hamstrings muscles of children with cerebral palsy (CP).

Materiels, patients and methods.– An electronic dynamometer (ISOBEX® 2.1, Cursor AG, Bern, Switzerland) [2], wall or ground mounted with a double sucker, was used to assess 10 CP children aged 6 to 12 years (mean: 8 years and 11 months), before the injections of botulinum toxin A and 2 months after the injections. Two muscular groups were tested (flexor and extensor of the knee). Three trials with a prior test were performed with resting of fifteen to thirty seconds between each trial. The statistical analysis was made on the average of the three measures with a one-way RM Anova (repeated measures analysis of variance).

Results.– We observed no significant differences in muscle strength immediately before and 2 months after injections of botulinum toxin A (all *P*-values > 0.076).
Discussion and conclusions.– We observe no change in muscle strength for both the injected muscle and his antagonist, two months after the injections of botulinum toxins. We cannot confirm our initial hypothesis. An earlier assessment might be needed to identify this variation.
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CO24-007–EN

Effect of shock wave therapy on muscle spasticity in children with cerebral palsy

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Keywords: Shock wave therapy; Muscle spasticity; Cerebral palsy

Aim of the study is to evaluate the effect of radial shock wave therapy on reducing muscle hypertonia in plantar flexor muscles in children with cerebral palsy.
Material and methods.– Eleven children with spastic plantar flexor muscles as a result of cerebral palsy were included in the study: 7 boys and 4 girls, age range 2–7, mean age 3.54 ± 1.013. Radial shock wave therapy was applied to the gastrocnemius and soleus muscle (BTL-5000 shock-wave series): 1000 shots to each gastrocnemius and soleus muscle.
Clinical and instrumental methods were used for the evaluation of the results: passive range of motion, modified Ashworth scale, pedobarometry before the treatment, immediately after it, 2 and 4 weeks later.
Results.– After a single shock wave stimulation, a significant increase in passive range of motion (with 17.13°, $t = 8.81$, $P < 0.05$) and a significant decrease in the Ashworth scale (from baseline mean 2.81 SD [0.65] to 2.11 SD [0.33]; $t = 6.19$, $P < 0.05$) were observed immediately after treatment. This effect was persistent two weeks later. The increase in passive range of motion was with 15.95°, $t = 5.22$, $P < 0.05$. The decrease in the Ashworth scale was preserved 2.11 SD [0.33] ($P < 0.05$). After placebo stimulation no significant difference was observed.
Conclusion.– Radial shock wave therapy could be appropriate adjuvant treatment for reducing muscle spasticity in plantar flexors in children with cerebral palsy. These are preliminary results and further study is needed to follow the long-term effect.
Further reading
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Analytical and functional analysis of the upper limb in children with hemiplegic cerebral palsy

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Keywords: Cerebral palsy; Children; Hemiplegia; Upper limb; Assessment

Introduction.– The upper limb (UL) of children with cerebral palsy (CP) requires a specific evaluation, which should apprehend movement efficacy and quality, and above all the usefulness of the assisting arm. To be relevant, this evaluation has to be based on appropriate and approved tools, which must display reproducibility and be sensitive to changes to measure the efficacy of therapeutic procedures.
Objectives.– We review the benefits and specificity of the following evaluation tools or scales:
–MACS [1], a global functional classification of self-initiated ability to handle objects;
–**analytical** evaluations:
1– surgically oriented classifications: **Zancolli**: for wrist and finger; **House**, **Matev** and **Corry**: for the thumb;
2– "**BCB**" (Bard and Chaléat) classification: covers the potential clinical patterns of CP, in spontaneous attitudes or in activity, and describes major patterns of the UL and hands types with muscular involvement for a treatment algorithm.
-**Functional** evaluations:
1– **QUEST** (Quality of Upper Extremity Skills Test), validated with younger children (18-months to 8-year-old);
2– **PRS** (Physician Rating Scale): simple 9-items scale scored out of 24 assessing the UL functional motricity;
3– **MUUL** (Melbourne Unilateral Upper Limb Assessment) [2]: video-recorded test battery validated for children aged 5–15. The abilities of one of the UL are separately assessed with 16 items, including approaching, grasping, handling and releasing functions;
4– **AHA** (Assisting Hand Assessment) [3], validated for 18-month to 12-year-old children. Measures and describes how effectively a child uses his affected hand in bimanual activities. The child is videorecorded while playing with toys in semi-structured play sessions (22 items).
Conclusion.– The combined use of analytical and functional classification offers a relevant observation, guiding therapeutical choices and treatment readjustment.
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Scapulo-humeral motion in hemiplegic cerebral palsied children

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Keywords: Shoulder; Scapula; Kinematics; Cerebral palsy; Children

Objective.– The aim of this study is to quantify the thoraco-scapulo-humeral motion in hemiplegic cerebral palsied children (HCP) compared with healthy children.
Materials and methods.– Ten children HCP and 10 typically developing children matched for age (11.8 and 11.2 years respectively) and gender (5 females) were included. 3D kinematics of the thoraco glenohumeral was collected in an optoelectronic system (VICON). The protocol used has been validated in children. It combines an acromial marker cluster, a static calibration of the scapula, and using the Euler XZY sequence for the kinematics of the glenohumeral joint [1,2]. The children carried out three planar movements (flexion, abduction, horizontal adduction) and 3 tasks (hand to head, hand to controlateral shoulder, hand to back). A paired Wilcoxon test was performed at 0% and 100% of the task as well as range of motion during the movement.
Results.– Children with HCP showed significant differences in scapulothoracic and glenohumeral kinematics in the 3 planes of the space according to the tasks.